Transforming Maritime Education: Local Decisions in Global Perspective

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Abstract Remaining dynamic and highly unpredictable, the modern maritime environment is getting more complex in the sense of being multidimensional. The traditional understanding of maritime environment as a specific area for transportation, fishing, and recently petroleum extraction, has changed significantly. The processes of globalization combined with the economic development give rise not only to new maritime activities, but also to the spreading out of the maritime domain deeply "on shore". As a result, a number of partly contradictory tendencies have emerged: narrow specialization and global management; multiagency involvement and standardized procedures; economic freedom and unified safety and security system. In line with the "good sea practice", maritime education is to be the integral component in the whole maritime domain. The real challenge of maritime education transformation is to provide common understanding, unified policy and standardized procedures in a multidimensional and multiagency environment. Presenting the conceptual framework for Bulgarian maritime education transformation, the paper stresses on cooperation among different national and international universities and agencies. The challenging role of the maritime academy in this "dispersed" educational system is to keep the integrity of the system and to provide commonality of the education. A special attention is paid to the problems of maritime safety and security education and training.

Keyword: *Maritime environment, Maritime education, Transformation, Maritime Safety and Security, Multidimensional and Multiagency environment.*

1. Introduction

Due to many reasons Bulgarian maritime domain recently is a subject of a process of radical transformation.
Some aspects of this process are spontaneous and driven predominantly by economic reasons. Traditionally these aspects are taken for granted and assumed to be environmental factors.
The second group of aspects is much "variegated" and is related to the objectives and policies of the maritime system's components. These aspects are considered to be relatively steerable and their management is regarded to be the very core of the transformational process.
Not going deeply in the tempting topic of "what in fact maritime transformation is", the paper addresses problems of the role of maritime education in preserving the integrity of the national maritime system[1].

[1] It is necessary to provide a definition for a national maritime system. For the purpose of the study the following one is applicable: the national maritime system is an aggregation of organizations which functioning is directly related to the maritime environment. The following considerations are to be added: (1) The maritime system is "naturally originated", that means that it is rather "a motive driven system" than "a goal driven system"; (2) The common motive of the system is an achievement and maintenance of a dynamic equilibrium among the components' goals; (3) The system's components are two types by origin – artificial (goal-driven) and natural (motive driven). The first group of components are established and

An investigation on the recent Bulgarian maritime situation development[2] reveals a set of partly contradictory tendencies:

1. Narrow specialization of maritime activities and global management of the branches.
2. Multiagency approach in processes management and necessity of standardized procedures.
3. High degree of economic freedom and establishment of a unified safety and security system.

These tendencies are typical not only for the area of maritime activities, neither they are brand new. Actually, evidences for the processes mentioned above can be traced back in the past. But the recent dimensions of the tendencies bring about new nuances of fragmentation of the maritime system, spontaneous interaction among components and lost of integrity of the maritime system (MS) as a unity.

In such circumstances the question about harmonization of the processes in the maritime domain is of vital importance.

Problems of the harmonization are directly related to the integrity of the system, which, in turn, is traditionally achieved by means of system centralization. This approach is traditional, partly valid, but predestinated to failure in a long term perspective[3].

Recent development of the organizational theory proposes an interesting concept for enhancement the integrity if the system, i.e. the concept of heterarchical[4] organizations. The idea for heterarchical organizations is a further elaboration of the idea of the so called multi-dimensional organizations, i.e. organization which structure is developed in result of multicriteria optimization, based on several (more than one) functions or goals.

Based on the aforementioned assumptions, the paper proposes some ideas for enhancing the system integrity in the environment of decentralized MS management.

2. Tendencies in the maritime domain

The global tendencies in the maritime domain are of particular interest for the study.

The **first global tendency** is one of the most tangible aspects of globalization: **the increasing role of the automation of the processes and subsequent tendency for professionalization of the activities**. Such a combination of automation and professionalization results in the following opportunities:

- formation of differentiated carrier fields;
- emergence of a managing personnel without a proper professional career development[5];
- the increasing part of maritime activities, especially logistics and management activities, are located "on shore";
- increase of the number of specialists necessary for proper functioning of a maritime organization;
- necessity of a common understanding of the problematic maritime activities and necessity of unified procedures and technologies.

Taking into account that the professionalization of maritime activities is the foundation of the processes in the maritime domain, the **second global tendency** is in a way resultant from it: **the establishment of a multiagency environment for maritime activities**. Very often functions, interests and responsibilities among different organizations in this environment overlap and, as result form an environment not only for cooperation, but also for competition. Both activities (cooperation and competition) require regulation, establishment of common rules and common values.

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sustained for the purpose of particular function performance. Typical representatives are the Navy, the Border Police, the Maritime Administration, etc. The second group is originated predominantly because of the existence of an "economy niche" suitable for doing business; (4) The word "national" in the definition is added because of the restriction of the study to the Bulgarian maritime organizations, independently of their international relations.

[2] The investigation is performed by the group of experts from Bulgarian maritime institutions in 2009 and 2010. The results of the scientific research are presented at the Fourth National Scientific Conference "Bulgarian Maritime Education and Training" – BulMET 2010 held at "N. Y. Vaptsarov" Naval Academy, Bulgaria, Varna, 17.06.2010.

[3] The idea of limited capacity of the centralized management is provoked by Schwaninger M. A Theory for Optimal Organization [6].

[4] A good understanding for the term "*heterarchy*" is provided by Eberhard Von Goldammer, Joachim Paul and Joe Newbury. Heterarchy and Hierarchy -- Two Complementary Categories of Description. [2].

[5] A typical example is a financial manager in a maritime organization. Usually the financial manager "enters" the system without a sufficient professional career throughout the hierarchy of the maritime activities.

The **third global tendency** is classically related to **the enlargement of the maritime activities geographically**. This process has two aspects:
- integration of the maritime systems of different countries;
- mutual "penetration" of considered to be different and separate for a long period of time "pure maritime" activities with "pure terrestrial" ones.

It has to be underlined that this tendency results in the already mentioned consequences of the first global tendency and especially in "on shore" location of maritime activities and enlargement of the number of specialists necessary for proper functioning of a maritime organization. Taking into account that the tendency of the professionalization of maritime activities relatively precedes and provokes the tendency of geographical enlargement, the existence of such "a reinforcing loop" of increasing professionalization because of geographical expansion is a clear evidence, not only of an iterative nature of the processes in the maritime domain, but also of the progressive and irreversible development of the global tendencies.

Notwithstanding the importance of the progressive development of the global tendencies in the maritime domain, one possible aftermath of mutual "penetration" of considered for "pure maritime" activities and "pure terrestrial" ones is of particular interest for the study: the inevitable "clash" between, on the one side "well arranged terrestrial thinking", and on the other – the traditional "freedom of maritime thinking" and related "exterritoriality" of the activities.

Obviously there is one more challenge to the MS integrity resulting from the confrontation between clear distribution of the responsibilities and areas on shore and traditional "exterritoriality" at sea. It is expected that the most tangible aspect of this confrontation will be in the area of maritime safety and security (MSS).

In fact, **the fourth global tendency** can be defined in the area of maritime safety and security: **establishment of a common maritime safety and security system**. This tendency should not be fragmentary considered as an agreement of common MSS procedures and centralized management of MSS matters only. It should be transferred to the traditional maritime "exterritorial acceptance" of the safety and security problems, generally expressed by the understanding of necessity of a national engagement in hot spots, like the Gulf of Aden, regardless the distance.

In other words, the tendency for establishment of a common maritime safety and security system poses a significant challenge on solving the controversies between maritime "global thinking" and the existing political frameworks.

3. Challenges to the maritime educational system

Without going in details, the multidimensional challenges to the maritime system can be summarized in preserving the "good sea practice" in the dynamic environment of maritime activities.

The practical aspect of the problem is to preserve the integrity of the MS.

In the multiagency and multidimensional environment for maritime activities, the role of the maritime education is the core of the system where the "good sea practice" is generated on the basis of MS components' common motives.

In order to formulate practical recommendations for the transformation of the maritime educational system[6] (MES), we are to answer the question how the MES reflects the global maritime tendencies.

Before answering the question, let us provide short description of the MES.

MES is a complex of educational institutions, their programs, curricula and courses. Some authors add that the MES is a subsystem, on the one hand of the MS, and on the other - of the national educational system. The statement is generally correct but incomplete. The definition lacks systematical understanding. The paper comments on three aspects of systematical understanding of the MES.

Firstly, any system possesses a managing body. Unfortunately, MES suffers lack of clear understanding about the managing body. Something more, being a part of the managing body, some of the MES components do not understand their role and the scope of their responsibilities and accountabilities. The lack of clear understanding about the managing body is often accompanied with

[6] It should be noted that despite addressing maritime education, we consider education and training matters to be inseparable.

the false sense of being in charge of some of the existing components. As a result, MES faces significant problems with:
- establishment of a common goal;
- elaboration of a long-term strategy;
- maintenance of synchronized functioning of the components.

In addition, MES suffers permanent financial problems.

The next aspect of systematical understanding of the MES is the lack of understanding of the "dual membership" of the components. Actually, the fact that some of the components belong to more than one supra-system is partly accepted, but only in the sense of being subject to more than one law, different financial systems etc. Additional attention is to be paid to the inevitable status of "multiple citizenship" of some of the MES components. This "multiple citizenship" is typical to the peripheral components and to networks and its misunderstanding very often leads to misbalanced system decisions, especially from a financial point of view.

The last aspect of systematical understanding of the MES is the narrow comprehension of the MES purpose. Traditionally the purpose is defined as follows: maritime education is a specialized education of the maritime personnel. It is possibly to add some trends as "wide spectrum of activities", "professional qualification" etc. The problem is that the proposed definition suffers narrow specialization.

The "systematic" role of the MES is to provide prerequisites for self-reproduction and self-maintenance[7] of the MS. In the very core of this purpose is the idea of providing prerequisites for adaptation of the MS to the dynamics not only in the maritime environment, but also in the processes within the system. The difference is that the second definitions reveals the necessity of a wide variety of feedbacks and stresses the necessity of "dispersion" of the educational functions among all MS components.

The second trend has a powerful theoretical and practical charge. In fact the necessity of "dispersion" of the educational functions among all MS components means that the MS and the MES are not different systems. They are different views on one and the same system.

Even though theoretical in nature, the problems of understanding of the systematic nature of the MES pose a significant difficulty for MES practical transformation. In fact, the Bulgarian MES has not been changed in the last two decades, it has only been amended to answer the requirements of the IMO or the EU[8].

Let us summarize and formulate the **"systematic" problems to the MES**:

1. There is not a clear understanding of the management of the system and the distribution of management responsibilities and accountabilities in the MES.
2. There is a lack of balanced system decisions that takes into account the membership of the MES educational components to different supra-systems. The consequent problems are most tangible in the financial sphere.
3. There is a lack of understanding that the purpose of the MES is to provide prerequisites for self-reproduction and self-maintenance of the MS. Practical dimensions of the problem are related to the necessity of:
   - wide variety of feedbacks;
   - "dispersion" of the educational functions among all MS components.

In general, there is a basic theoretical challenge: how to elaborate and apply a "systematic" decision in "non-systematic" environment.

Before proposing a solution, let us consider the way MES reflects the global maritime tendencies.

The reflection of the global processes is presented as two priority directions for transforming the MES.

The **first group of priorities** is related to **updating the maritime education**. The specific activities are:

- balancing the necessity of a wide spectrum education with practical and focused professional specialization;

[7] For more information see Mednikarov B. and K. Kalinov, "An alternative of the system approach to functional aspects analysis of the Maritime Crisis Management System" [5].

[8] The real problem is not the lack of changes. The problem is that being different views of one system, MS and the MES behave differently in the last two decades. In contrast to the radical change of the Bulgarian MS, the MES underwent a sporadic and politically driven reform.

- adaptation of the education of "non-maritime" specialists to the specifics of the maritime education;
- updating and adaptation of the rather basic technical maritime education to the requirements of the different management levels in maritime affairs.

Accomplishment of these activities is to be closely related to the peculiarities of the national educational system and to the traditions of maritime education.

In fact the problem of preserving the traditions is of vital importance for the **second group of priorities**, aimed **at preserving the integrity of the system**:

- generation of a common understanding of the aspects of maritime activities;
- establishment of a potential of knowledge for elaboration of common maritime policy;
- formulation of common standards for unified management processes and (when possible and necessary) management and technical procedures.

Obviously the idea of the MES transformation requires a profound development. For that reason the paper presents only a conceptual framework of the MES, focusing on the following aims:

1. Provision of a continuous education of the maritime specialists.
2. Establishment of a multicomponent MES.

Additional requirements to the system are:

1. Possibility for integrating the education of the maritime and "non-maritime" specialists for the purposes of maritime affairs.
2. Integration of MS components' efforts considering their interests and potential.

Issues, related to generation of a common understanding of the aspects of maritime activities and establishment of a potential of knowledge for elaboration of common maritime policy are considered to be secondary. It does not mean that they are of a lower priority. The aim is to achieve them by providing structural prerequisites in the MES organization for establishment of the desired system properties.

Finally, the issue of formulating common standards for unified management processes and (when possible and necessary) management and technical procedures is considered to be a priority of educational programs.

4. Possibilities to establish an adaptive maritime educational system

The most difficult objective of system engineering is the process of transforming theoretical principles into practical recommendations in the context of a given environmental status for the purpose of achieving a desired system functioning.

Taking into account that the formulated tendencies and the suggested priority activities are predominantly a mixture of the environmental status and the desired system functioning, let us introduce briefly the theoretical foundations of the proposed structure of the Bulgarian MES.

Not going into details, three ideas deserve to be presented:

1. The idea for the heterarchical organization of the MES.
2. The concept of adaptiveness.
3. The notion of fractal dimension of management functions and the related structures.

The idea for the **heterarchical organization** of the MES is based on the assumptions that

- on the one hand, comprehension that the MS and MES are different views on one system, and
- on the other hand, there is a need for "dispersion" of the educational functions among all MS components.

The practical dimension of the idea for heterarchical organization of the MES can lead to the establishment of a network-based MES able to transform the common motives of system's components into a common educational policy based on common educational goals.

The **concept of adaptiveness** is based on the assumption that the educational process serves the function of system adaptation [4, pp. 25-30].

On the other hand, despite being a process of setting and maintaining desired behavior, the management process is based on reactions [3].

Notwithstanding that two concepts overlap, they pose some distinguishable requirements and some additional explanations are necessary.

Assuming that education is a process of adaptation, we have to take under consideration that "adaptation takes place on at least three different levels" [1, pp. 292-294]. Based on this, we have defined three levels of system adaptiveness: short-term adaptiveness, long-term adaptiveness, and evolutionary adaptiveness.

Short-term adaptiveness is a process of adaptation to the current situation. It is therefore a process of direct and situationally-oriented adaptation. It is performed predominantly by the way of functional adjustment. The process of functional adjustment is very often related to selection of a functional model (scheme) that is relevant to the situation.

Long term adaptiveness is a process of adaptation to relatively predictable future conditions of the environment. In addition to the functional adjustment, it is performed by elaboration of structural prerequisites for functional adjustment to possible future situations. The practical execution of this process usually includes: making prognoses; analysis of possible situations; and elaboration of adequate reactions.

The evolutionary adaptiveness is observed in unpredictable situations. It is therefore performed by elaboration of structural prerequisites for the necessary system's properties for adaptation in cases of unpredictability or, in other words - emergency.

It is a good idea to make a parallel between, on the one hand, the three levels of adaptation, and on the other – the three levels of management (tactical, operational and strategic). Going one step further, we can state to a great extent of certainty that the maritime educational process has to provide prerequisites for the three types of adaptiveness[9].

As already mentioned, there are three typical levels of management: tactical, operational and strategic. They can be briefly described as follows:

1. Strategic management is responsible for formulating a long-term organizational policy. Generally it is related to the mission and desired end state formulation.
2. Operational management is a process of preparation, performance, and control of the processes that transform different types of resources into a desired product through applying a particular strategy. Typically operational management is an elaboration of a given set of objectives that define the strategy.
3. Tactical management is a process of estimating the peculiarities of the situation and achieving a specific strategic objective. Inseparable part of the tactical management is the process of selection of the proper procedures for successful accomplishment of a certain activity in the specific circumstances.

Given high level of specialization and repeatable technological processes we can add one more management level: technological (or operating). Technological management in fact "materializes" the tactical management. It can be defined as a process of direct management of typical activities and standards.

It should be noted that very often technological management is not considered to be management, but manufacturing procedures. We do not make e clear distinction between management and manufacturing activities because of the following reasons:

- maritime system tends to be network organized and heterarchical which means that not only the management, but also the manufacturing activities are "dispersed" among the components;
- the high rate of automation of manufacturing activities turns them into a management of technological systems.

Having in mind the above, we can present **the notion of fractal dimension of management functions and the related structures**. Without going into details, we can state that the proper functioning of an organization requires a "self-similarity" between any two neighboring in the hierarchy management levels. The self-similarity property directly affects system's functioning which, in turn, results in fractality (self-similarity) of the structures. The idea of fractality is to provide a fluent transition from the higher hierarchical level's decisions to a lower hierarchical levels' performance.

General model of the desired system for maritime education and training (E&T) is presented on Fig. 1.

[9] For more details concerning the idea of making a parallel between, on the one hand, the three levels of adaptation, and on the other – the three classical levels of management see *Boyan Mednikarov, Nikola Stoyanov and Kalin Kalinov Challenges to Education and Training in the Field of Harbour Protection Security. Maritime Transport & Navigation Journal, Vol. 1 (2009), No. 1.*

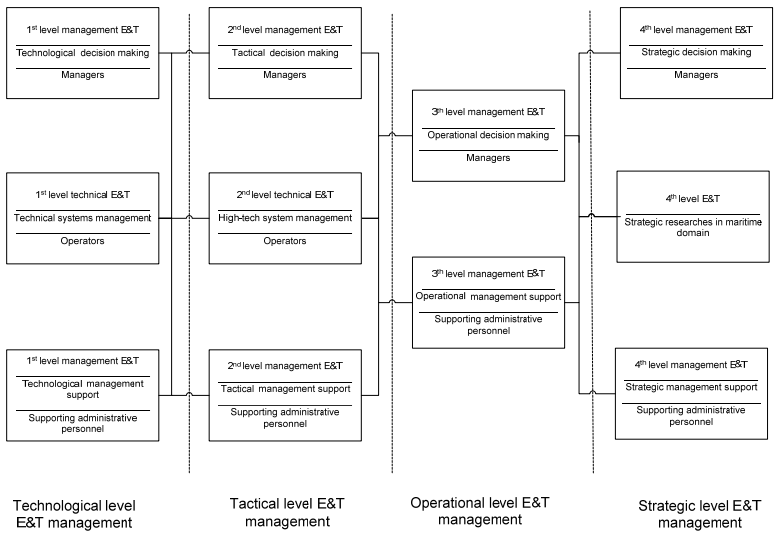

Fig. 1 Levels of education and training of the maritime personnel

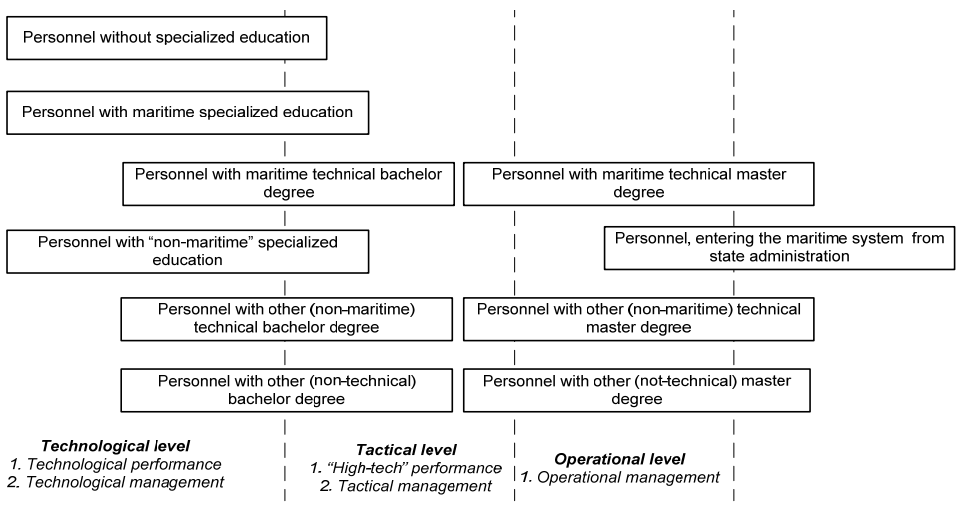

Fig. 2 Allocation of the personnel on different MS hierarchical levels according the education obtained (Current status)

Taking into account that the reactions to a situation are a composition of acquired experience and theoretical preparedness, the E&T main points of the proposed model at different E&T levels are:

1. Technological E&T level is to provide behavioral models for performance of standard functions. The educational process is closely affected by the existing technological basis.
2. Tactical E&T level is to provide behavioral models for adequate reaction to a standard situation. It is more management oriented than the Technological E&T level. An exception is the technical orientation of the education for high-tech systems operators.

3. Operational E&T level is to provide a wider range of behavioral models for recognition of the peculiarities of a given situation and includes the ability to set objectivities for achieving a goal in a dynamic context.
4. Strategic E&T level is to provide general behavioral models applicable for wide range of situations and includes the ability to formulate missions and supporting goals for long-term management.

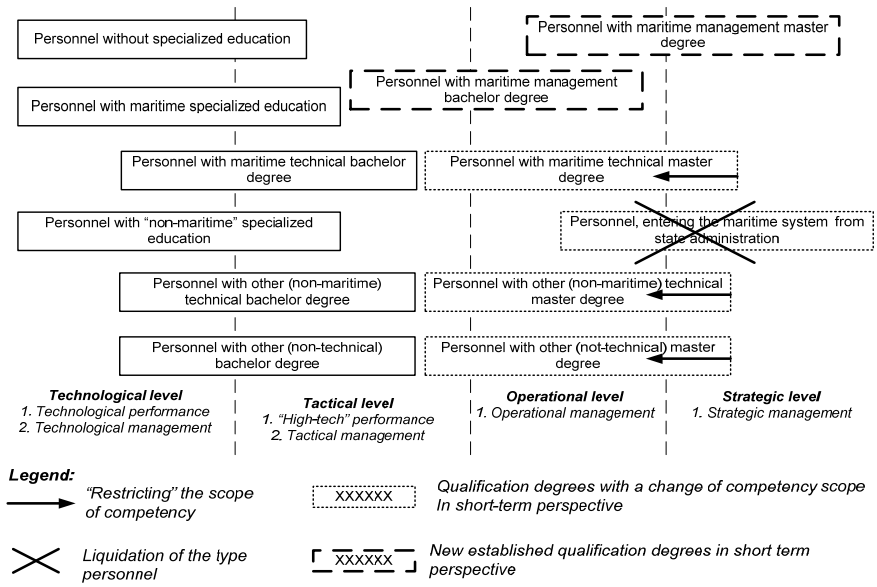

Fig. 3 Allocation of the personnel on different MS hierarchical levels according to the education obtained (Guidelines for short-term changes)

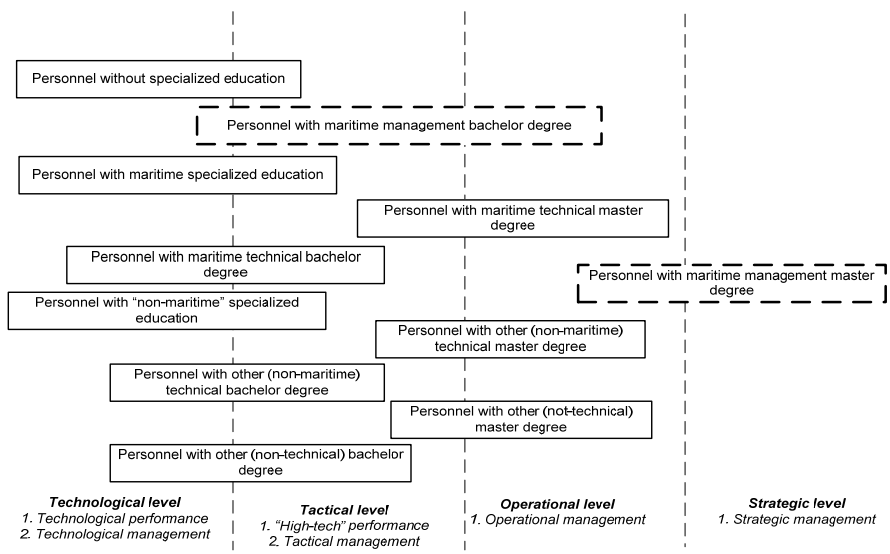

Fig. 4 Distribution of the personnel on different MS hierarchical levels according to the education obtained (Desired status)

The idea of MES transformation is interrelated to a different view on the MES which describes the allocation of the personnel on different MS hierarchical levels according to the education obtained. The current status is given on Fig. 2.

We should stress the high dependence of the maritime organization on personnel that is not a "product" of the MES. In such cases the possible after-effects could be:

1. Difficulties in establishment of common understanding of the maritime aspects.
2. Increasing inner conflicts.
3. Lost of "maritime identity".

The proposed suggestions for solving these problems are schematically presented on Fig. 3.

After transforming the MES the expected short term change in the distribution of the personnel on different MS hierarchical levels according to their educational level is presented on Figure 4.

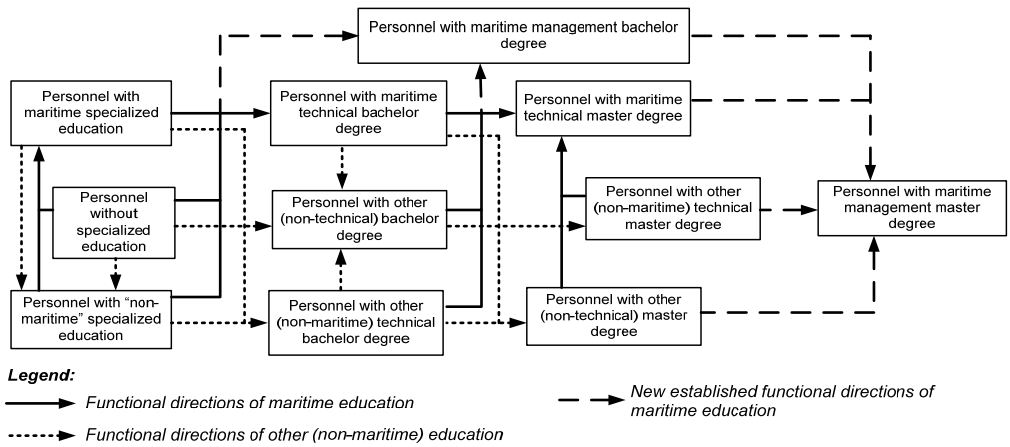

Fig. 5 Enhancement of the professional qualification of the personnel of a maritime organization (a short-term option)

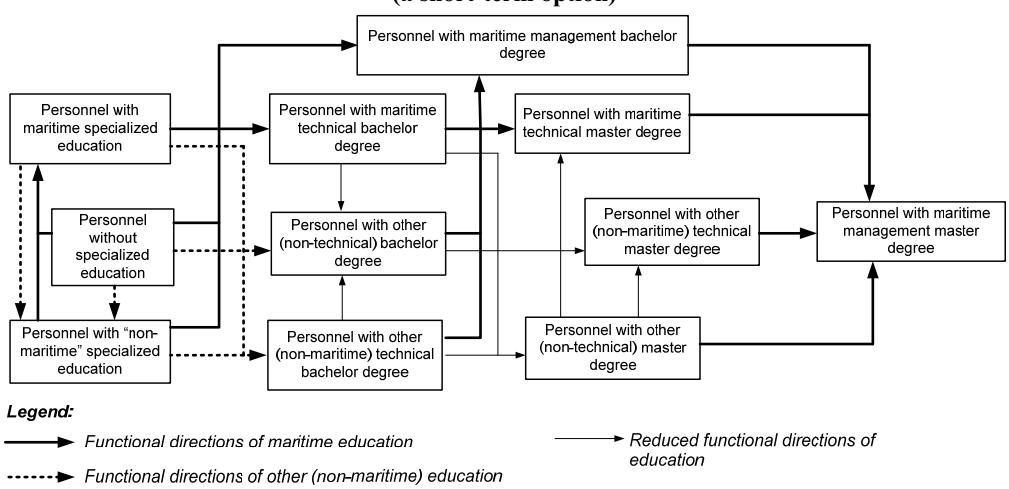

Fig. 6 Enhancement of the professional qualification of the personnel of a maritime organization (a long-term change)

Such a change will result in an enhancement of the professional qualification of the personnel of a maritime organization in short-term as presented on Figure 5.

The long-term expected change of the system for enhancement of the professional qualification of the personnel of a maritime organization is of particular interest. The expected change of the MES is presented on Figure 6.

The long-term changes are generally related to reducing the possibility for educational enhancement of the tactical and operational level maritime personnel in "non-maritime" educational institutions. This will definitely contribute to the establishment of common understanding of the maritime management and will result in enhanced national maritime system integrity.

5. Conclusion

Since the Bulgarian MES model for transformation is in a process of development and elaboration, we would like to underline the possible challenges for its successful implementation.

The first group of challenges is due to the fact that MES changes require cooperation between the MS elements. After transforming the MES the expected short term change in the distribution of the personnel on different MS hierarchical levels according to their educational level is presented on Figure 4. On the one hand the components of the maritime system, and on the other – the components of state supra-systems, i.e. educational system, security system, etc.

Solutions to the possible problems are rooted in the following **initiatives**:

- development of a national maritime strategy that considers maritime prosperity as based on the dynamic balance of national security, economic freedom and personal safety;
- active involvement of the maritime industry in the management of the maritime educational system, including direct participation in the processes of setting up educational priorities with subsequent implementation in the educational programs.

The second group of challenges is related to the already established relations in the national educational system. Some problems are expected because of insufficient capacity of the existing maritime institutions to provide adequate educational support to the transformation of the MES.

The possible general solution to the aforementioned problems is provided by the idea for **unified** educational programs involving the capabilities of different maritime educational institutions. Such cooperation is in full compliance with the idea of dispersed responsibilities in the maritime education. Such a solution for MES transformation is a type of Local Decision in Global Perspective.

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